TT 84-1-0508

From: Meditsinskaia Parazitologiia i Parazitarnye bolezni, Vol. 49, No. 2, 1980, pp. 46-51.

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V. V. DUBROVSKAYA

BREEDING AREAS OF THE BLOOD SUCKING MIDGES IN THE STEPPE ZONES OF UKRAIN

DON MEDICAL INSTITUTE

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S U M M A R Y

In the Donetsk region, larvae and pupae of 18 midge species of the genus Culicoides were found: C. nubeculosis, C. riethi, C. puncticollis, C. salinarius, C. circumscriptus, c. manchuriensis, C. homochrous, C. fascipennis, C. subfascipennis, C. ustinovi, C. maritimus, C. simulator, C. alazanicus, C. odibilis, C. vexans, C. albicans, C. reconditus, C. punctatus, and Leptoconops borealis. The analysis of the lietarure and the own data showed that in the Donetsk region, in particular, and in the steppe zone in general breeding places of midges are localized and focal. The association of midge larvae of C. nubeculosis, C. riethi, C. puncticollis, C. salinarius, C. circumscriptus and C. manchuriensis with oozed wellheated water bodies, C. vexans larvae with drying water bodies with grass vegetation, larvae of C. fascipennis, C. subfascipennis, C. maritimus, C. simulator, C. odibilis, C. reconditus, and C. punctatus with biotopes with grass and sedge vegetation was observed. Breeding places of C. homochrous, C. ustinovi, C. alazanicus have been found first in the world. Larvae of C. alazanicus were found to develop in shallow waters in scirpus of the river Kazenny Torets, larvae of C. homochrous in shallow water bodies of floodlands of the river severny Donets, and C. ustinovi larvae in floodland water bodies grown with grass and sedge in the river Kazenny Torets. Priazovie flood plains, salted water maeshes are places of mass breeding of C. riethi, C. salinarius, C. manchuriensis, C. maritimus midges, less so C. puncticollis and Leptoconops borealis.

In order to develop a method to safeguard against, and measures to fight the blood sucking midges, it is not enough to know the biology of the adult insects but also the pre-imago phases of their development.

The breeding areas of blood sucking midges within the USSR have been studied by many scientists (1-5, 7, and 9-16). Analysis of the data obtained (8) have illustrated that the habitat of the midges is dictated by the water and temperature factors. Within the forest zones the areas of breeding of the midges are diffused. Within the Steppe Zones the breeding areas of the insects are strictly localised and are found in natural or man-made basins/pools. The number and existance of midges depends on the nature of the river beds and the hydraulic conditions of the rivers. The Donetzkij region, where we carried out research, is situated in the Steppe Zone. The station to station studies to determine the breeding areas were carried out from 1969 to 1976 in flood-plains and along the river beds of the Severskij Donetz, Kazennyj Toretz, Bakhmut, Gruzskij Elanchik, Kleban-Byk, Sukhoj Toretz, Kalmius, within the interfluve (in the Malinovka village), and on the shores of the Azove sea within the limits of the Donetzkij region.

The larvae and pupae of midges were collected from different biotopes. The specimens were placed in vessel with water, carefully stirred and these pupae that came up to the surface were then moved with the help of a small brush into a smaller vessel. In the laboratory they were then transferred into test tubes with damp cotton wool lining the test tubes and retained there till the appearance of imago. To collect the larvae of midges we employed the method suggested by Kettle and Lawson (19), modified by V.M. Glukhova (6, 8). The mature stage IV larvae were kept in segregation, one from the other, in hour glasses with a little water. The hour-glasses were placed in Petri dishes the bottom of these dishes were first covered with damp filter paper. The Petri dishes were checked daily. After the pupae were formed the skin of the larvae was preserved in 96% alcohol (and sometimes in formalin).

In order to obtain quantitative data of the pre-imago phases we collected standard specimens along water lines using a 10 x 5 cm aluminium frame and up to 2 cm deep. All pupae were kept in test tubes with damp cotton till the imago had appeared and the larvae were preserved in 96% alcohol. A total of 445 specimens were treated. We collected 32904 larvae and 5539 pupae.

RESULTS OF ANALYSIS

The hydrological analysis of the Donetzkij region has illustrated that the main focal point for breeding in mass

of midges are rivers having complexes of flood plains of various types, basins along the river valleys and interfluve reservoirs.

Special place is taken by the shallow water bodies on the shores of the Azov sea. Here, below, we illustrate a brief description of various impounded reservoirs of water analyzed by us, distributed in different landscapes indicating the varieties of midges and phases of larvae and pupae discovered in these water bodies.

I. River beds and river shores

1. The Severskij Donetz river. In shallow waters and along the water line in slimy regions of the shores of this river we collected, en masse, larvae and pupae of the Culicoides nubeculosus, C. puncticollis, C. riethi, C. salinarius, C. circumscriptus, C. manchuriensis, C. odibilis and to a lesser content C. punctatus. In the swampy area of the shore we determined the presence of pre-imago phases of the 3 latter species.

2. The Kazennyj Toretz river. The shore is sloping, silty and overgrown with reeds. The river line is well lighted by the sun and gets a lot of heat. In the silted regions of the shore along the river line and in the shoally waters we determined the same 7 species, in masses, as those observed in the river Severskij Donetz. On the silted regions of the shore having sparsely growing grass and sedge we found, the C. salinarius, C. circumscriptus, C. manchuriensis and less often we came across C. vexans, C. alazanicus and C. maritimus.

3. The Gruzskij Elanchik river. In the regions of slimy shores, without vegetation, we found in large numbers C. puncticollis, C. riethi, C. circumscriptus, C. manchuriensis, whereas in the swamped regions of the shore overgrown with grass and sparse growths of sedge, larvaea and pupae of the C. simulator, C. odibilis, C. pulicaris and pupae of C. ustinovi were discovered.

4. The Bakhmut river. In the regions of shallow water and slimy shores covered with black mud, without any vegetation (water here has high contents minerals), we have determined

a large quantity of larvae and pupae of the C. nubeculosus, C. puncticollis, C. riethi, C. salinarius, C. circumscriptus and C. manchuriensis.

5. The Kleban-byk river. The 6 species of midges found in the Bakhmut river were determined en masse on the littoral section of this river and on the shores that were silted up and bare of all vegetation.

6. The Kolontaevskij river. On the silted up sections of the shore and in the accumulations of stringy algaewe observed, en masse, larvae and pupae of the C. riethi.

For all the above determined biotops shallow depths near the shores, very poor currents, silty soil (very often denuded of vegetation) are characteristic. In swampy regions we came across usual type of vegetation that are characteristic of humid meadows and partially aqueous - pond weeds, squatic jointweeds and duckweed.

The water in those rivers dirty, highly mineral and muddy.

II. Fluvial river plains

The fluvial of Severskij Donetz river. The insect breeding areas of this fluvial region, producing blood sucking midges, were oxbow lakes, shallow drying up water ponds in the lower beds, marshy flooded meadows with overdamp sections and slowly flowing brooks.

1. The marshy lakes are situated in the open section of the fluvial plains and in the forests. An example of one such area breeding the insects is a small and not very deep marshy lake, elongated in its shape (30 x 10 m) highly silted. The banks of this lake are overgrown with grass and some shrubs. The specimens taken from such areas produced the pre-imago phase of the C. riethi, C. nubeculosus, C. puncticollis, C. salinarius, C. manchuriensis. In a lake of a similar kind but smaller in size we have observed larvae of the nubeculosus group in fairly sizeable quantities and some odd larvae of the salinarius group. A similar

composition of midges was also observed in lakes of larger dimensions (150 x 80 m) with its banks overgrown with grass and fluvial oak forest, but the number of larvae and pupae of midges here was substantially less.

2. The intermittent impounded lakes, drying up at the start of summer. Such water bodies form in the low-lying plains and get filled up with flood-water. The vegetation here is grassy and meadow bog type with some additional moss. These water bodies are in the open and are well heated by the sun. In such impounded lakes we found, in not very large quantities, larvae and pupae of the C. homochrous, C. vexans, C. reconditus C. punctatus, C. simulator, C. odibilis and C. fascipennis.

3. Swamped perennial shallow and not very extensive basins situated on a damp meadow and damp soil. The vegetation here consists of sedge and it is grassy with moss. The water gets heated well, but is colder than the previously described type of biotop as a result of interflow with subsoil waters. The soil is sandy-silt or silt. In these biotops we discovered pre-imago phases of the C. salinarius, C. circumscriptus, C. manchuriensis, C. vexans, C. reconditus, C. punctatus, C. ustinovi and C. fascipennis.

4. Stagnant brook. The flow of water is very poor or else altogether absent. Heavy growth of magnificent aquatic vegetation, sedge and in places there are rushes growing. In summer some portions of such brooks dry up turning the brook into a chain of small stagnant water bodies. The areas without water almost always remain moist. We determined C. salinarius, C. circumscriptus, C. manchurensis, C. punctatus and C. odibilis.

5. Pond-excavation. Not very large, the soil is sandy-silt, the water gets well heated. The bank in places is overgrown with reeds. There are many stringy algae. We have discovered, in a mass, larvae and pupae of the group of nubeculosus and salinarius; a few odd larvae and pupae of the C. odibilis were also uncovered.

Fluvial of the Kazennyj Toretz river. The main part of this fluvial, in the area under study, is plowed up and is under cultivation. Only a meadow approx. 3 km in length and some 0.5 km in width has been preserved in the lower contour. In spring this area gets filled with the flood or melted show water, which remains till the end of June-beginning of July. At this stage there are small bodies of

water. The vegetation is meadow motley grass, sedge and reed.

In the temporary water holes with grassy vegetation and moist soil we found numerous larvae and pupae of the C. vexans and a smaller number of larvae and pupae of the C. simulator, C. ustinovi, C. maritimus, C. reconditus, C. punctatus. The temporary water holes with growths of sedge exhibited the presence of larvae and pupae of the C. simulator.

III. The valley

The valley of the Severskij Donetz river. In the area under study the original (basic) shore line is not demarcated. The width of the valley is from 4 to 26 km. The valley is part of the sub-zone of the northern motley grass-fescue-feather grass steppe. The soil is sandy, in some parts of the valley there are artificial plantations of pine trees.

The following breeding areas are characteristic of the valley; natural lakes - fresh salt, water, small, periodically dry basins; various artificial water basins (pond-excavations, sand quarries, irrigating canals, etc.) moist meadows, swamps, sandy regions with copious and constant wetting.

1. Meadow that dries up during the summer months, formed in place of overgrown lake. The vegetation is grass where sedge is predominant. In small excavations we found a few larvae and pupae belonging to nubeculosus group.

2. Oxbow-lake. The oxbow lakes with silt or sandy - silt shores turned out to be areas of mass breeding of midges of the C. riethi, C. puncticollis, C. nubeculosus and groups of salinarius.

3. Artificially made lakes. These lakes are very similar to the oxbow lakes as far as the conditions of the habitat is concerned as well as the range of species of the breeding midges.

4. Sandy quarries. The latter differ by the small number of midges present there. There we observed a few odd larvae and pupae of the nubeculosus and salinarius groups.

5. Brooks originating from springs. Here we found larvae and pupae of the C. nubeculosus, C. puncticollis and C. rethi.

Salt lakes. The Rapno, Slepno and Veisovo lakes have in places sloping banks. In the vicinity of the silty banks and in accumulated filar algae near the banks we have collected, in mass, larvae and pupae of the C. riethi. In specimens from an area of 200 cm^2 (20 x 100 cm) we found up to 1000 larvae and pupae.

Valleys along the Bakhmut river. In the temporary water bodies and bogged area we have found larvae of the nubeculosus group.

IV. The interfluve.

The interfluve of the Severskij Donetz river basin and its tributary rivers, namely, the Kazennyj Teretz and Bakhmut are characterised by the absence of large natural basins. The breeding areas are artificial ponds of various dimensions, formed from spring and brooks, small pools of stagnant water along the banks of the brook, and excavations holes.

1. Ponds. The large pond of the Malinovka village. In certain areas the pond has steep banks alternating with sloping banks, the soil is silty. The vegetation grassy. Among specimens found on the slping banks, we found in large numbers larvae and pupae of the C. puncticollis, C. nubeculosus and larvae of the salinarius group. A similar pond in the Tikhonovka village also proved to be an area of mass breeding of the larvae and pupae described above.

2. Brooks. From the pond in the Malinovka village flows out a brook approx. 1.5 m in width. The current is strong, the bottom of the brook is sandy, banks have accumulated much silt and in places are overgrown with grass.

In the silty areas we found a large number of larvae and pupae of the C. nubeculosus and C. puncticollis and the salinarius group. In a similar brook (village Tikhonovka) we observed, in mass, the C. nubeculosus and C. puncticollis.

3. Stagnant water (swamps). As a model we have taken a large swamp in the lower stream of the brook, this swamp is very heavily overgrown with sedge and reed. In a few areas, and in small numbers, we have observed larvae of the nubeculosus group, the larvae of the salinarius group were much more numerous. In more open areas the C. subfascipennis are breeding.

4. Excavation holes. A hole of 15 m^2 (3 x 5 m) in the Malinovka village is a watering place for ducks. Its maximum depth is 1 m. The banks are devoid of vegetation and they are silty. Here we found that a large number of the C. nubeculosus, C. puncticollis, C. salinarius and C. manchuriensis are observed to develop. Hole-excavation of 10 m^2 (5 x 10 m) with silty banks, in the Tushicheskij forest proved to be a breeding place of types of insects as those in the Malinkova village.

V. The Shores of the Azov sea.

The articles published by foreign publications (17, 18 and 20) contain information on the breeding of midges in water holes along the sea shore. The attack by the midges Leptoconops in the near shore regions of the Caspian was noted by Sh. M. Dzjafarov (10).

Our analysis at the shores of the Azov sea have illustrated that the Priazov plavni (in Russian plavni means low parts of downstream valleys covered with reed and trees) and salty-water marshes are the breeding areas, en masse, of midges belonging to the C. riethi, C. salinarius, C. manchuriensis, C. maritimus, as well as, Leptoconops borealis.

The breeding of the midges type C. riethi, C. puncticollis and C. maritimus took place in periodically dry, barren shallow water basins with silty soil. The temperature of water in these small basins varied from 20 to 27°C.

In some areas, where there was mass breeding of the C. riethi, the water was salty and marshy with sparsely growing grass as vegetation, and only in deeper hollows and in moister areas, reeds and reed mace growing. The soil of these swamps was silty-sand, in some places clogged up with decaying remnants of vegetation; these marshes have a direct outlet into the sea. Here, besides the C. riethi, a common find were C. salinarius, C. manchuriensis and C. maritimus species, and, rarely, C. puncticollis.

CONCLUSIONS

1. In the Donetzk region for the first time we studied breeding areas and found 18 species of midges of the Culicoides genus: C. nubeculosus, C. riethi, C. puncticollis, C. salinarius, C. circumscriptus, C. manchuriensis, C. homochrous, C. fascipennis, C. subfascipennis, C. ustinovi, C. maritimus, C. simulator, C. atazanicus, C. odibilis, C. vexans, C. albicans, C. reconditus and C. punctatus.

The breeding areas of the blood sucking midges within the limits of the Donetzk region in particular and in the steppe zone in general are localized and focal. The main focal points for the mass breeding of midges are rivers having a complex of marshy water bodies, water reservoirs in river valleys, interfluvial basins and shores of the Azov sea.

2. The larvae of the C. nubeculosus, C. riethi, C. puncticollis, C. salinarius, C.manchuriensis and C. circumscriptus develop in all kinds of biotops. The larvae C. nubeculosus, C. riethi, C. puncticollis are found, en masse in silty shallow water basins, void of vegetation, well heated by the sun (or along the shores of large water basins provided the conditions are similar to those described).

The larvae C. fascipennis, C. subfascipennis, C. maritimus, C. simulator, C. odibilis, C. albicans, C. reconditus and C. punctatus develop in biotops overgrown with grass and sedge vegetation; the C. vexans larvae are found in temporary water holes that dry up at the beginning of summer and that have grass vegetation.

For the first time in the world we were able to determine areas of breeding of C. homochrous, C. ustinovi, and C. alazanicus. The C. alazanicus larvae have been found in the reeds of shallow waters of the Kazennyj Toretz river, the C. homochrous larvae were found in the tidal marshy shallow water basins of the Severskij Donetz river, the C. ustinovi larvae were sampled in the tidal marshy water basins overgrown with grass and sedge vegetation of the Kazennyj Toretz.

4. Priazov plavni (see explanation given for "plavni" by translator in para 37), salty-water marshes are the areas for mass breeding of the midges C. riethi, C. salinarius, C. manchuriensis and less commonly observed are the C. punctticollis, as well as, Leptoconops borealis.

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